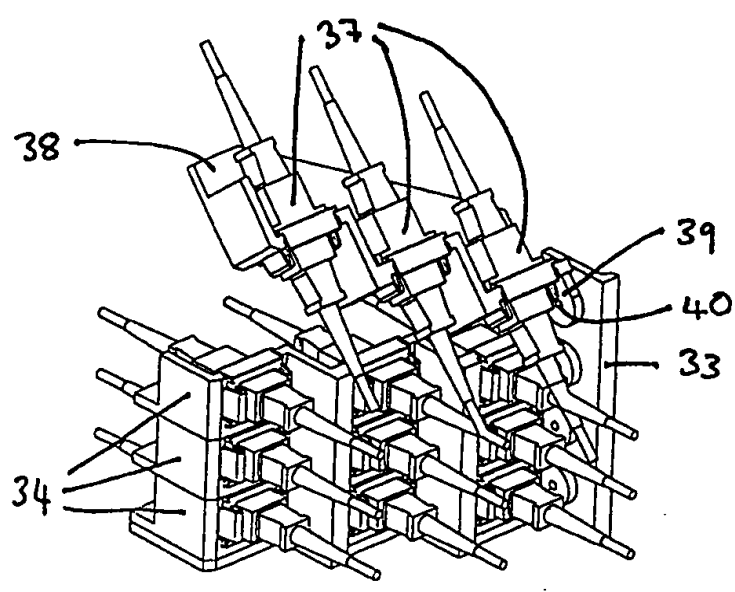




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : G02B 6/44</p>	<p>A1</p>	<p>(11) International Publication Number: WO 99/42881 (43) International Publication Date: 26 August 1999 (26.08.99)</p>
<p>(21) International Application Number: PCT/GB99/00318 (22) International Filing Date: 29 January 1999 (29.01.99) (30) Priority Data: 9803481.2 20 February 1998 (20.02.98) GB 9810134.8 13 May 1998 (13.05.98) GB (71) Applicant (for AT AU BE BR CA CH CN CY CZ DE DK ES FI FR GB GR ID IE IL IN IT JP KR LU MC MX NL NO PL PT RO RU SE TR UA only): N.V. RAYCHEM S.A. [BE/BE]; Diestsesteenweg 692, B-3010 Kessel-Lo (BE). (71) Applicant (for MG only): RAYCHEM LIMITED [GB/GB]; Faraday Road, Dorcan, Swindon, Wiltshire SN3 5HH (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): PIECK, Amandus [BE/BE]; Hanenstraat 10, B-3382 Kortenaken (BE). DE COSTER, Pieter [BE/BE]; Wolvendreef 52, B-3210 Linden (BE). WAMBEKE, Alain [BE/BE]; Solveld 32, B-3440 Zoutleeuw (BE). PEETERS, Erik [BE/BE]; Goede Haardlaan 9, B-3001 Heverlee (BE). DEMESMAEKER, Marc [BE/BE]; Sint Maartensstraat 91, B-3000 Leuven (BE).</p>		<p>(74) Agent: JAY, Anthony, William; Raychem Limited, European IPLD, Faraday Road, Dorcan, Swindon, Wiltshire SN3 5HH (GB). (81) Designated States: AU, BR, CA, CN, CZ, ID, IL, IN, JP, KR, MG, MX, NO, PL, RO, RU, TR, UA, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.</p>
<p>(54) Title: FIBRE OPTIC PATCH PANEL</p> <p>(57) Abstract</p> <p>A patch panel for supporting a plurality of fibre optic connectors, in which patch panel the connectors are movable from a first position in which the connectors are compactly arranged to a second more spaced apart position in which access to the connectors is facilitated.</p> 		

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FIBRE OPTIC PATCH PANEL

This invention relates to fibre optic management systems or distribution centres and in particular to patch panels for use in such systems and centres.

Fibre optic management systems or distribution centres are used for the organisation of optical cables and connectors. Such management systems can take the form of a cabinet situated on the street or within a building and are used for separating and organising the optical fibres and cables entering the building. A fibre optic management system can also take the form of equipment racks in a central exchange, such as a central telephone exchange, or sub-racks at customer premises. In such management systems fibre connectors are supported on a fixed panel known as a patch panel. Patch panels are used for securing and retaining the connectors of fibres and cables and the connectors are generally arranged on the patch panel in rows and columns. Access to individual connectors on a patch panel after initial installation is often required to allow changes such as reassignment to be made to those connectors. At headend or exchange environments in particular reconfigurations, testing and expansion are regularly required so easy access to individual connectors is essential. Access to individual connectors can, however, be impeded due to general lack of space and the fibres and cables running to adjacent connectors.

At present there is a great need to increase the connector capacity in cabinets and racks. Increasing the number of connectors in any given space, however, causes accessibility problems. There is, therefore, a need for an orderly fibre distribution centre or management system which provides easy access to individual connectors but which allows the connectors

to be retained in close proximity to each other in an orderly manner. In addition the ease of access needs to be effected without deleterious effect on any adjacent connectors, fibres or cables.

According to the present invention there is provided a patch panel for supporting a plurality of fibre optic connectors, in which patch panel the connectors are movable from a first position in which the connectors are compactly stored to a second more open position in which access to the connectors is facilitated.

One way in which movement from the first to the second position may be effected is by movement of the entire patch panel. The patch panel may, for example, be mountable so as to be movable from the first to the second position. The patch panel may as an example be pivotally or more preferably slidably mountable.

Alternatively or additionally the patch panel allows for individual movement of connectors or movement of selected groups of connectors. In other words individual connectors or groups of connectors may be movable with respect to at least part of the patch panel on which they are supported.

The patch panel of the present invention preferably consists of a main body or frame and at least one support member. The support member is the part of the patch panel in which the connectors are mounted. Preferably each support member is used to support a plurality of connectors and each patch panel has a plurality of support members so that an array of connectors can be mounted in the patch panel. Each support member of the patch panel may

be independently movably mounted within the main body so as to allow movement from the first to the second position. Each support member may, for example, be pivotally mounted on the main body so as to be able to swing out away from a first position in which it is compactly arranged within the patch panel to an open position in which there is easy access to all of the connectors mounted on that support member. Alternatively each support member is slidably mounted in the main body to allow translational movement of the support member and all of the connectors mounted thereon from the first to the second position.

The connectors may be mounted in groups of varying number within the support member. They are, however, preferably individually mounted therein. When the support member is movable with respect to the main body the connectors may be statically mounted with respect to the support member. The connectors may, however, be movably mounted with respect to the support member whether or not it itself is movable. Groups of connectors may be so mounted or individual connectors may be independently movably mounted. In one embodiment of the present invention each individual connector is independently movably mounted with respect to the support member. The means by which the connectors are movably mounted can take any appropriate form and the connector may be capable of pivotal, translational or other movement with respect to the support member and other connectors. The connectors are preferably slidably mounted within the support member, for example the connectors could be retained in a mount slidable within a groove provided on the support member. Each connector preferably has its own individual mount so slidably mounted. In cases where movement between the two positions is effected only by sliding individual connectors within a static support member it may be necessary for the support

member to be of a size sufficient to accommodate all of the connectors mounted thereon and allow them to slide from a first compact position to a second accessible position. In such a case the support member, rather than being filled to capacity with connectors, should preferably be provided with a space into which individual connectors or groups of connectors may be moved.

The means by which the connectors are retained and secured within the patch panel, for example within individual mounts, may take any suitable form such as those means conventionally used in the art.

It is preferred that movement of the connectors from the first to the second position can be effected by hand without the need for additional or specialised tooling.

The patch panel may be provided with means for locking the connectors in either or both the first or second position. Locking of the connectors in place is desirable as it provides them with resistance to shock and/or vibration during use. It is preferred that the means for locking and unlocking the connectors is such that locking can be effected by hand without the need for additional or specialised tooling. Means by which the connectors may be locked into position include projections or indentations provided on the patch panel so as to be able lockingly to engage with a connector mounted therein.

The tubing or cabling on either side of the connector must be long enough to allow the connector to be moved from the first to the second position, i.e. it must be sufficient to allow movement of the connectors without causing loss of transmission or transmission damage

during the movement. There should also be sufficient room within the patch panel to allow for any such slack, fibre or cable to be stored.

The present invention also provides a fibre optic management system, such as a cabinet or rack, incorporating a patch panel of the present invention as hereinbefore described.

The present invention is advantageous as it solves the problem of reduced accessibility which occurs when the number of connectors in any given space is maximised. It does so by enabling the connectors on a patch panel to be moved. This allows the connectors to be arranged in a more compact manner thereby increasing capacity while at the same time ensuring that each connector may be conveniently accessed, for example, by moving adjacent connectors out of the way or by moving the connector away from another obstruction.

For a better understanding of the present invention, and to show how the same may be put into effect, reference will now be made, for the purposes of illustration only, to the accompanying drawings in which:

Figure 1 is a perspective view of a conventional patch panel already known in the art;

Figure 2 is a perspective view of a first embodiment of a patch panel according to the invention in a first position; and

Figure 3 is a perspective view of the first embodiment in a second position;

Figure 4 is a perspective frontal view of a second embodiment of the present invention shown in use in a fibre optic management box in a first compact position;

Figure 5 is a perspective rear view of the second embodiment shown in Figure 4;

Figure 6 is a perspective frontal view of the second embodiment shown in a second open position;

Figure 7 is a perspective rear view of the second embodiment shown in Figure 6;

Figure 8 is a schematic and enlarged view of a detail of the second embodiment;

Figure 9 is a perspective view of a third embodiment of the present invention;

Figure 10 is a plan view of an enlarged detail of one embodiment of means for retaining a connector in position on a patch panel according to the present invention;

Figure 11 is a plan view and an enlarged detail of a second embodiment of retainer means;

Figure 12 is a plan view and an enlarged detail of a third embodiment of retainer means;

Figure 13 is a perspective view of a fourth embodiment of a patch panel according to the invention in a first position;

Figure 14 is a perspective view of the fourth embodiment in a second position;

Figure 15 is the view of Figure 14 with some connectors removed for clarity;

Figure 16 is a perspective view of the fourth embodiment in a third position with further connectors removed; and

Figure 17 is the view of Figure 16 with all connectors removed for clarity.

Figure 1 shows a conventional patch panel of the type used in a cabinet for separating and organising optical fibres to be connected end to end, for example prior to entering or within a building. The patch panel 1 takes the form of a corrugated support holding an array of connectors 2. Each of the connectors 2 is mounted within a separate opening in the patch panel. The patch panel 1 holds the connectors 2 forming the connections between one group

of fibre optic pigtails 3 extending out of the cabinet (not shown) and another group of pigtails 4 which extend onto hinged splice trays (not shown). Although the patch panel shown in Figure 1 allows for a relatively compact arrangement of the connectors 2 it is necessary to space them by a certain distance from one another in order to ensure that individual connectors particularly those at the bottom of the columns or rows, can be accessed for changes to be made after initial installation. Even with such spacing access is minimal.

The patch panel shown in Figure 2 is a first embodiment of the present invention and is formed from a main body 5 from which a series of racks or support members 6 extend in stepped relation to one another. Each support member 6 takes the form of a frame, which is substantially rectangular in shape and frames a substantially rectangular aperture 7. Within each aperture 7 a series of connectors 8 are mounted. This is in contrast to the conventional patch panel 1 of Figure 1 in which the connectors 2 are mounted in individual openings. Here instead of individual openings the connectors are mounted in rows in one large aperture 7. Each connector 8 is held within the aperture 7 by means of its own individual mount 9 which includes resilient clip arms (not shown) which retain the mount to the aperture but allow it to slide along the aperture 7 of the frame of the support member 6. In Figure 2 the connectors 8 are at rest and stored beside each other at one end of the aperture 7. The support member 6 is not filled to capacity with connectors. Instead a space is left to allow the connectors to be individually and independently slid from their stored position to spaced apart position such as that shown in Figure 3 in which better access and more space for handling is provided. The connectors 8 can be held in the spaced apart position shown in Figure 3. The cabling 11 on either side of the connector 8 must be long enough to allow the

cabling 11 to move a certain distance when the connector 8 is slid from its stored or rest position as shown in Figure 2 to any spaced apart position such as that shown in Figure 3. When the connector 8 is moved to and from its rest position there should be room for the cabling, if necessary, to bend a little.

Tests on the embodiment shown in Figures 2 and 3 for insertion loss before, after and during manipulation of the connectors from the rest to the open position have been carried out and it was found that there was no substantial change in signal during that movement.

The patch panel shown in Figures 2 and 3 provides accessibility to connectors during re-entry to the patch panel when used in a fibre optic network. During such re-entry it is much easier to gain access to the connectors because the connectors can be slid to the top of the patch panel and thereby more space for handling is created. The patch panel is also advantageous as it allows the connectors to be held in place both in the rest and open position. It is desirable for the connectors to be held in place during use to resist shock and/or vibration during their lifetimes use. The retention means of the present embodiment is designed so that positioning and release can take place by hand without a need for additional tooling. Similarly movement of the connectors may also be carried out by hand.

In Figures 4 to 8 there is shown a second embodiment of the present invention, which is a high density connector patch panel 12 mounted within a fibre optic management box 13. The connectors 14 are arranged in rows and columns within the patch panel 12. The patch panel 12 is slidably mounted within a pair of guide members 15 having a substantially U-shaped groove or channel for receiving the patch panel 12 and in which it can move up or

down. Above the patch panel 12 and in this case attached thereto are a pair of hingedly mounted front and rear protective covers 16 and 17 to protect the front and rear cabling connected by the connectors 14 respectively. The protective covers 16 and 17 may be lifted to provide access to the connectors 14. In addition the front protective cover 16 can be lockingly engaged by a frontal retention plate, which in this case takes the form of three upstanding pillar-like members 18a, b, c which may be hingedly mounted. The patch panel 12 is shown in Figures 4 and 5 in a closed position. In Figures 6 and 7 the patch panel 12 is shown in an open position after it has been slid upwards in the direction of the arrow through the guide members 15. In the open position connector access is optimised. If required the patch panel 12 could be adapted to allow for individual connectors or groups of connectors to be slidably movable with the patch panel 12 to increase accessibility further.

Figure 8 shows schematically how the patch panel 12, the front protective cover 16 and the retention plate 18 can be moved.

The third embodiment of the present invention (shown in Figure 9) is a further patch panel 19 mounted within a fibre optic management box 20. As with the embodiment shown in Figures 2 and 3 the patch panel 19 has a series of elongate aperture support members 21 extending in stepped relation to one another. Each support member 21 has a row of connectors 22 mounted in a single aperture therein. The connectors 22 are each held in a respective mount 31 having two opposite resilient arms 23 which act as spring clips to hold the mount 31 in the aperture. The mounts 31 are all spaced apart on the support members 21. They are each held in place in this spaced arrangement by small projecting lugs 25 which project into the aperture parallel to the plane of the support member 21 in pairs on either side

of the aperture. Manipulation of the resilient arms 23 allows a connector 22 to be released from its retained position and moved along the aperture within the support member 21. Appropriate movement of the relevant adjacent connectors 22 within the support member 21 allows the space either side of any particular connector 22 to be increased.

In Figure 10 is shown in detail one support member 21 from the array of such members shown in Figure 9. The support member 21 is provided with means for retaining a connector mount 31 which means, as described above, take the form of projecting lugs 25 which extend within the plane of the support member inwardly into the aperture 26. The support member 21 is provided with a series of these projecting lugs 25 on either side of the aperture 26. Each series is spaced so that a pair of lugs 25 are in opposing positions and are able to firmly retain a connector mounted between them. The opposing pairs of lugs 25 in effect form a series of bays along the support member 24 for receiving connector mounts 31.

An alternative means of retaining connectors into position is shown in Figure 11. In this embodiment the support member 27 is provided with a series of opposing indentations 28. In the further embodiment shown in Figure 12 the opposing indentations 29 are provided with a recess 30 which assists in retaining the connectors.

A fourth embodiment of the invention is shown in Figures 13 to 17. The patch panel 32 of the fourth embodiment has a main body 33 from which a series of racks or support members 34 extend. Each support member 34 is provided with a series of substantially orthogonally opposed pairs of faces 35, the pairs extending in stepped relation to one another. Provided in alternative faces 35 are open-sided apertures 36 in each of which a connector 37 can be

individually mounted along the lines described above. The pairs of faces 35 extend substantially perpendicularly from a tray or base plate 38 with which each support member 34 is provided. Each support member 34 is pivotably mounted to the main body 33 via a mounting flange 39 attached to an end face 35 on each support member 34. The flanges 39 are each independently swingable about a pivot pin 40 mounted on the main body 33.

In use the patch panel 32 can be placed into a closed, compact position (as shown in Figure 13) in which the series of support members 34 extend in parallel one on top the other and with a connector 37 mounted in each of the apertures 36 a dense array of rows and columns of connectors is formed. To obtain access to individual connectors the uppermost of the support members 34 is pivoted to a more open, access position (as shown in Figure 14). Connectors 37 can be easily slid through the open side of the apertures 36 for removal. Further access is obtained by swinging out more of the support members (see Figures 16 and 17) as required.

It is clear that this fourth embodiment allows not only dense, compact packing of connectors but easy access to individual connectors as and when required.

CLAIMS

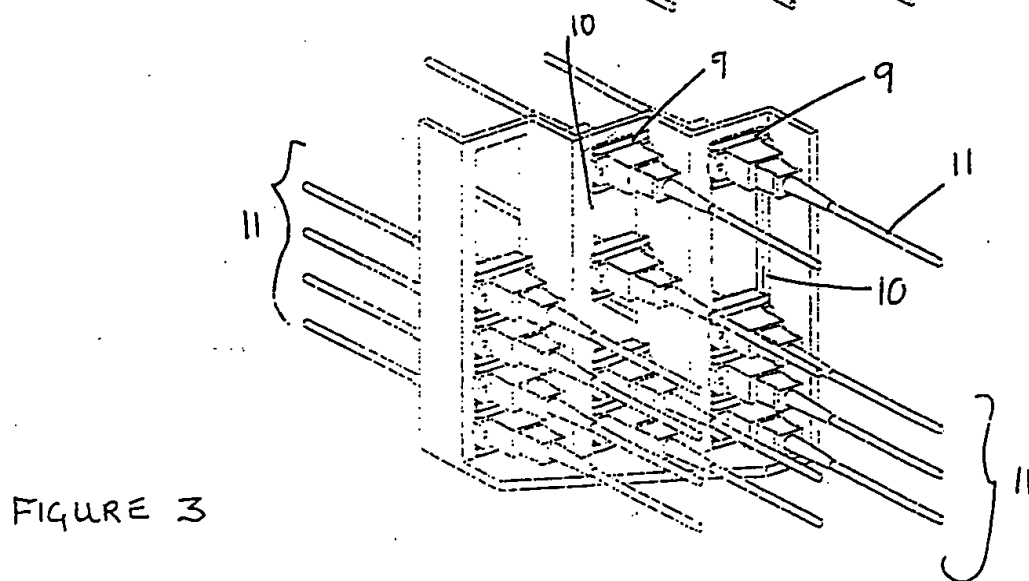
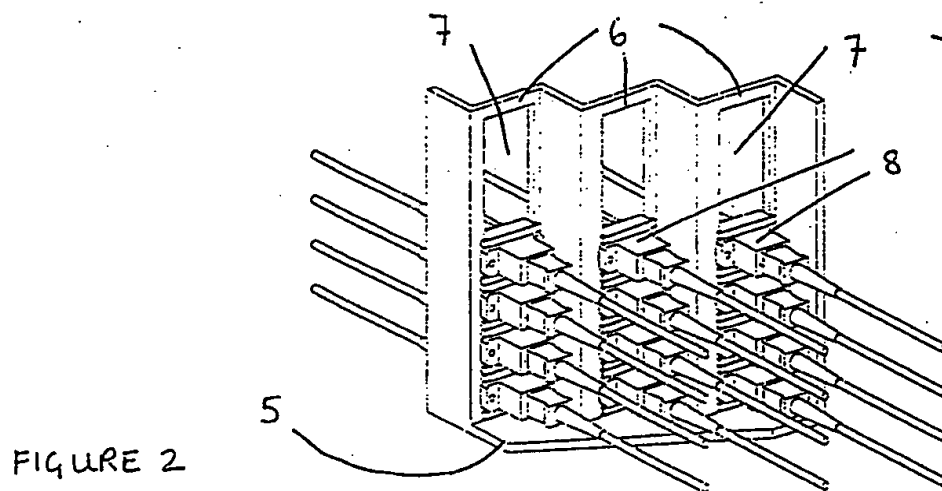
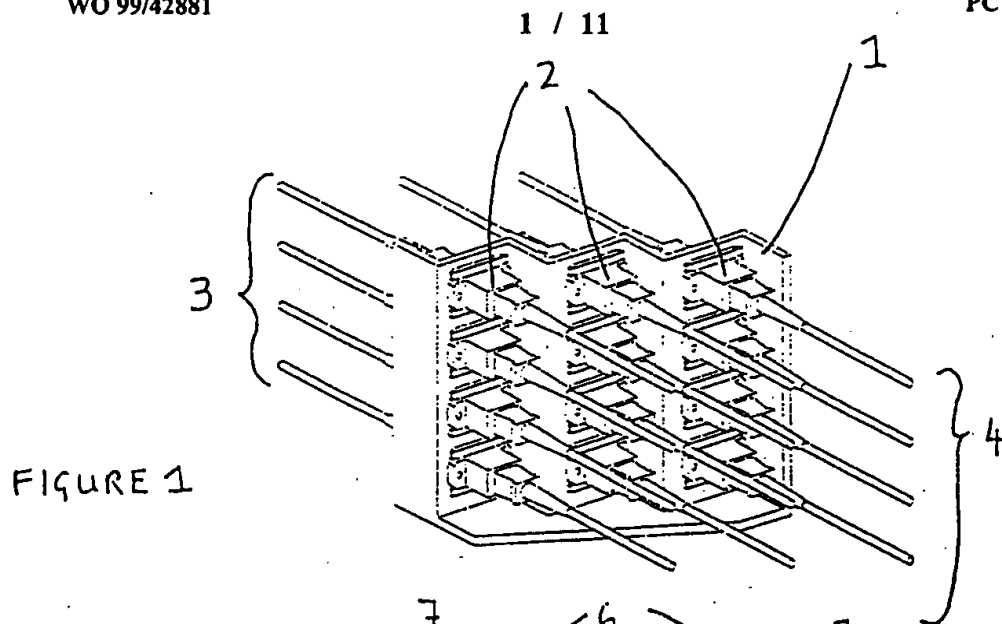
1. A patch panel for supporting a plurality of fibre optic connectors, in which patch panel the connectors are movable from a first position in which the connectors are compactly arranged to a second more spaced apart position in which access to the connectors is facilitated.
2. A patch panel according to Claim 1, wherein groups of connectors or individual connectors are movable with respect to at least a part of the patch panel from the first to the second position.
3. A patch panel according to Claim 1 or Claim 2, wherein groups of connectors or individual connectors are slidably mounted in the patch panel for movement from the first to the second position.
4. A patch panel according to Claim 3, wherein each connector is independently slidably mounted with respect to the patch panel for movement from the first to the second position.
5. A patch panel according to any preceding claim, in which the connectors are mounted within one or more support member.
6. A patch panel according to Claim 5, wherein the connectors are slidably mounted within the support member.

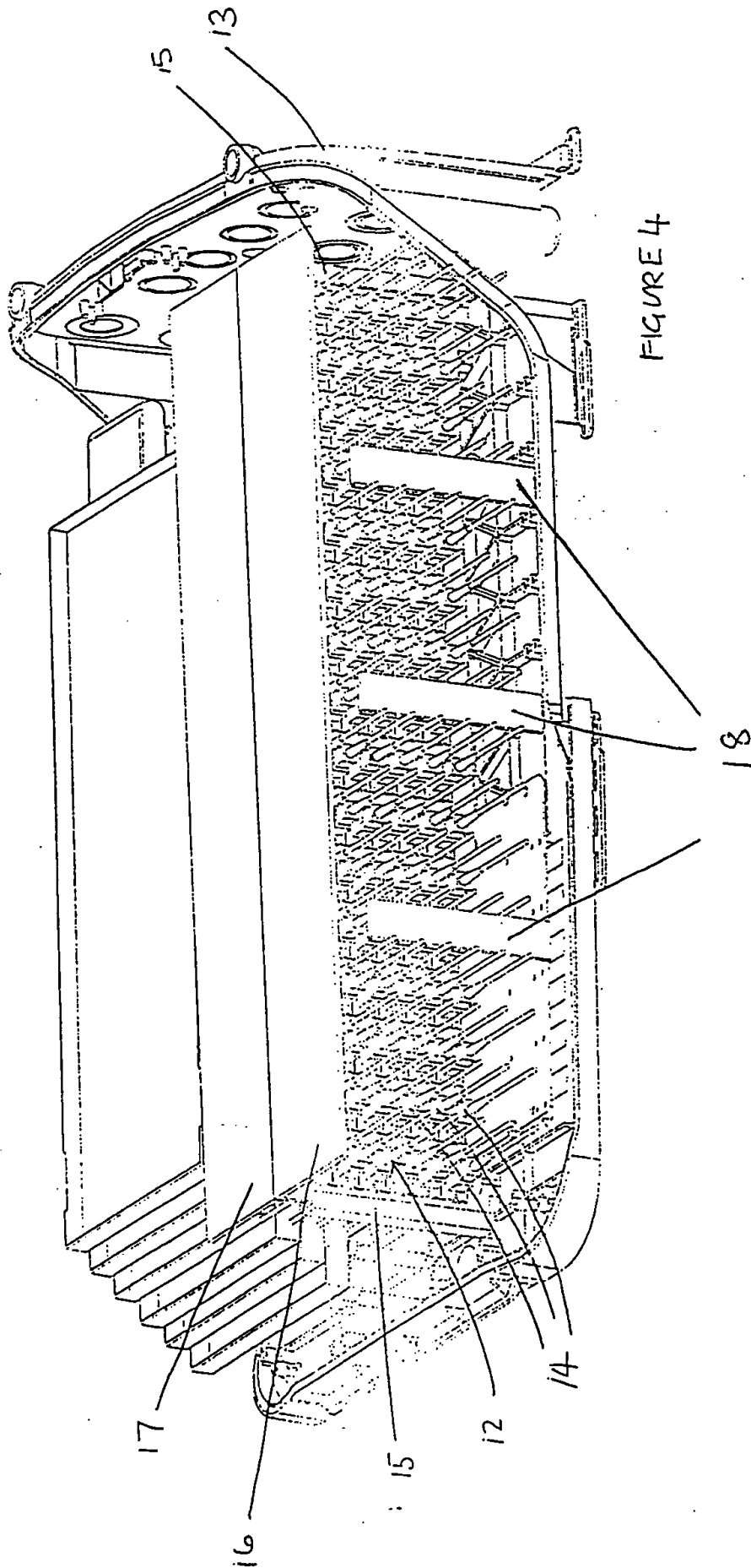
7. A patch panel according to Claim 5 or 6, wherein the or each support member is provided with an aperture for mounting more than one connector.
8. A patch panel according to Claim 7, wherein the connectors are slidable within the aperture of the support member and space is provided within that aperture to accommodate such movement of the connectors.
9. A patch panel according to Claim 5, wherein the or each support member is movably mounted with respect to the patch panel.
10. A patch panel according to Claim 9, wherein the or each support member is pivotally mounted on the patch panel.
11. A patch panel according to any preceding claim, wherein means are provided for retaining the connectors in either or both the first or second position.
12. A fibre optic management system incorporating a patch panel according to any one of Claims 1 to 11.
13. A fibre optic management system according to Claim 12, wherein the patch panel is slidably mounted with respect to the other components of the system.

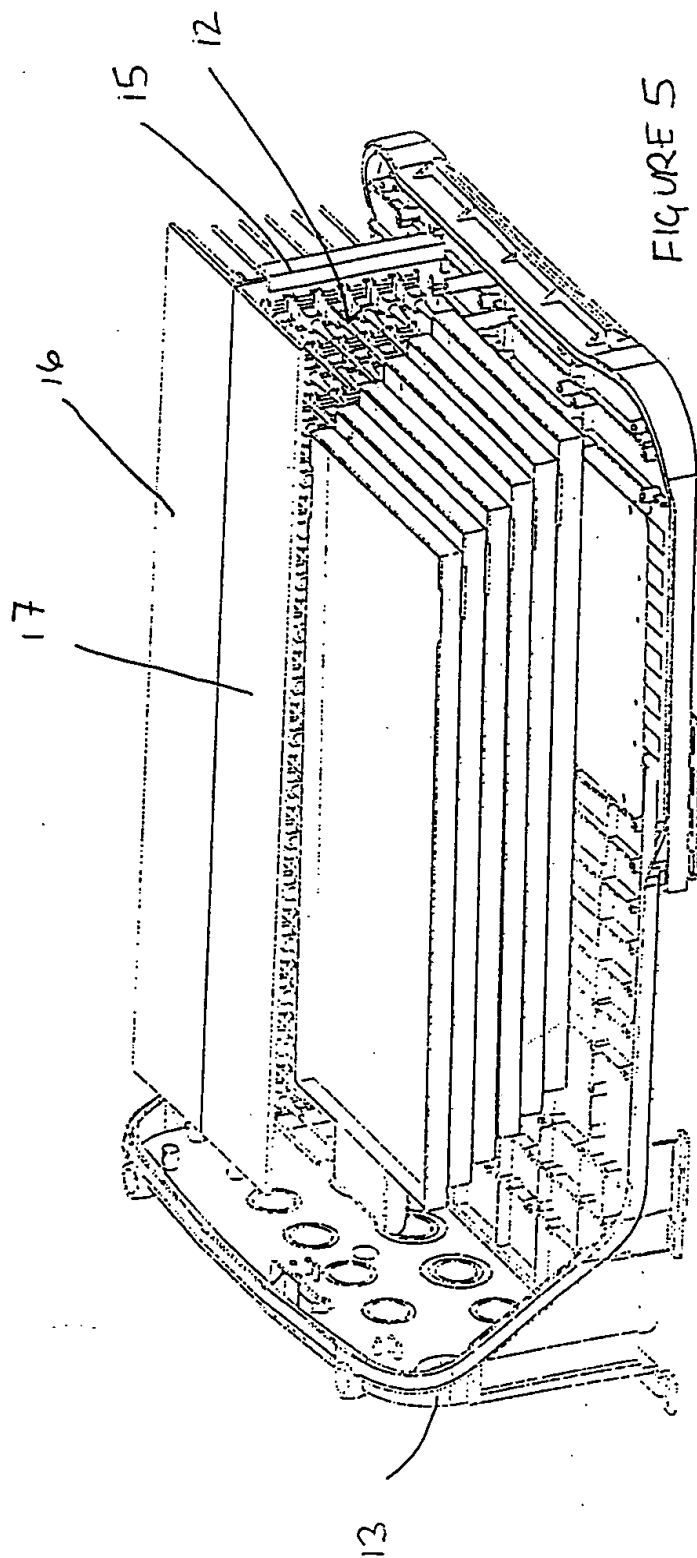
14. A patch panel substantially as hereinbefore described with reference to, and as illustrated in, Figures 2 and 3; Figures 4 to 8; Figure 9; Figure 10; Figure 11; Figure 12 or Figures 13 to 17 of the accompanying drawings.

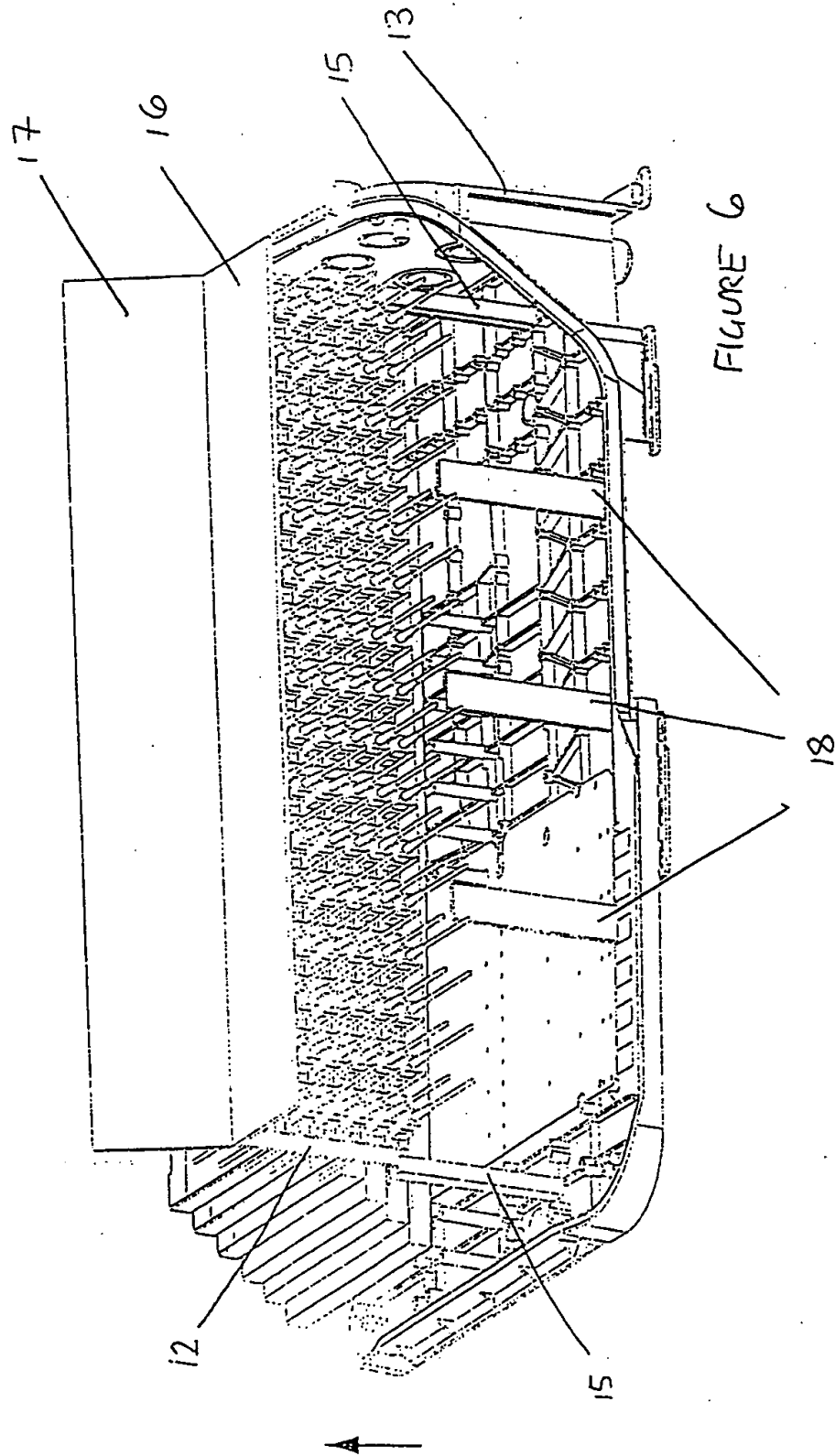
15. A fibre optic management system incorporating a patch panel substantially as hereinbefore described with reference to, and as illustrated in, Figures 2 and 3; Figures 4 to 8; Figure 9; Figure 10; Figure 11; Figure 12 or Figures 13 to 17 of the accompanying drawings.

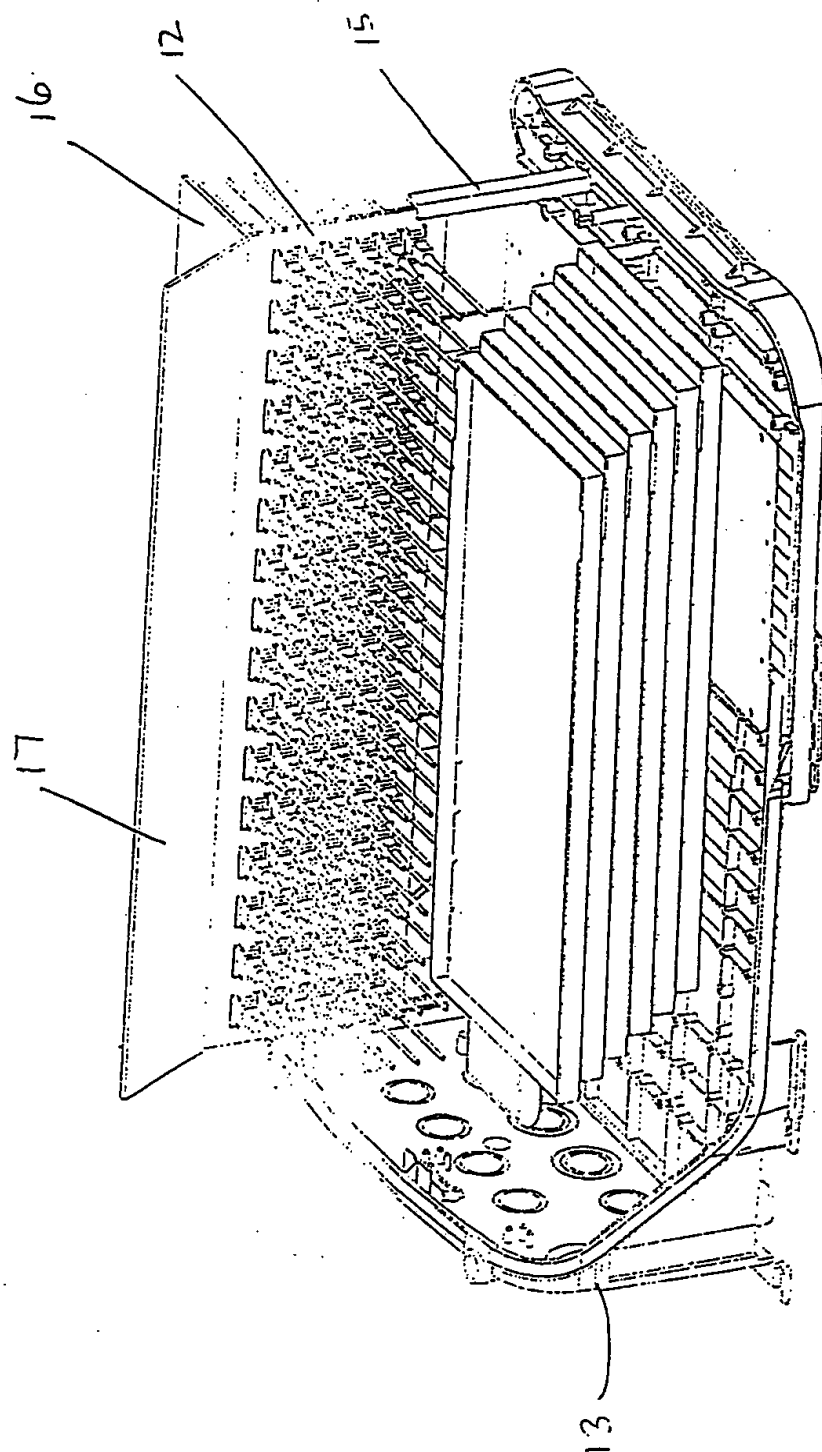
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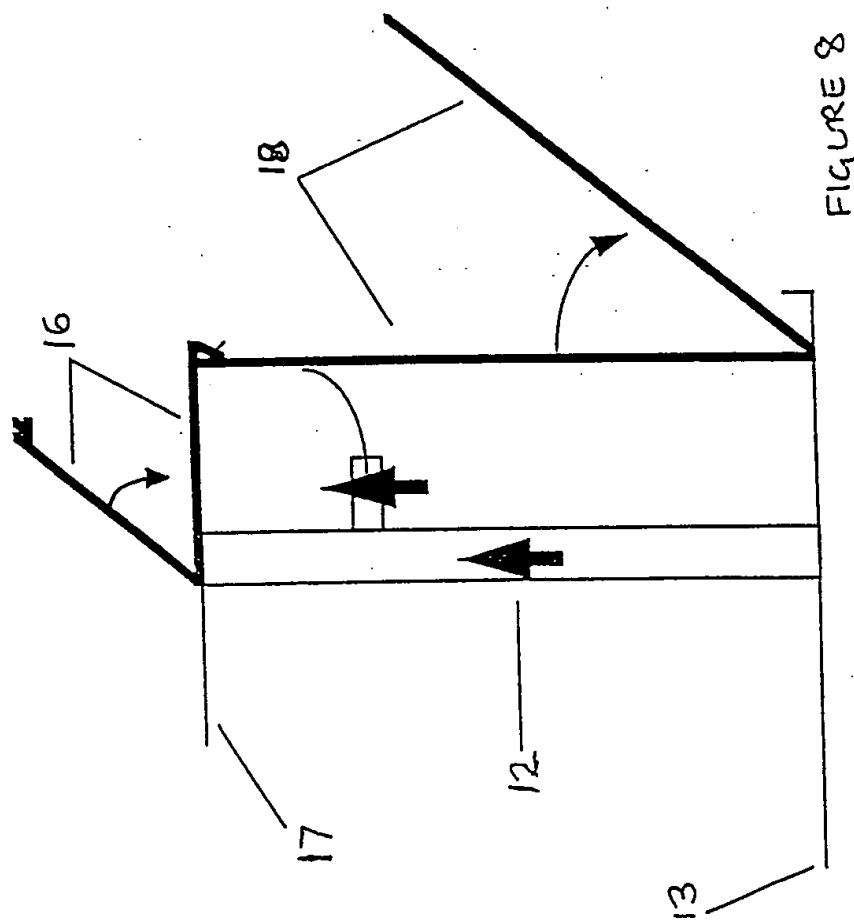


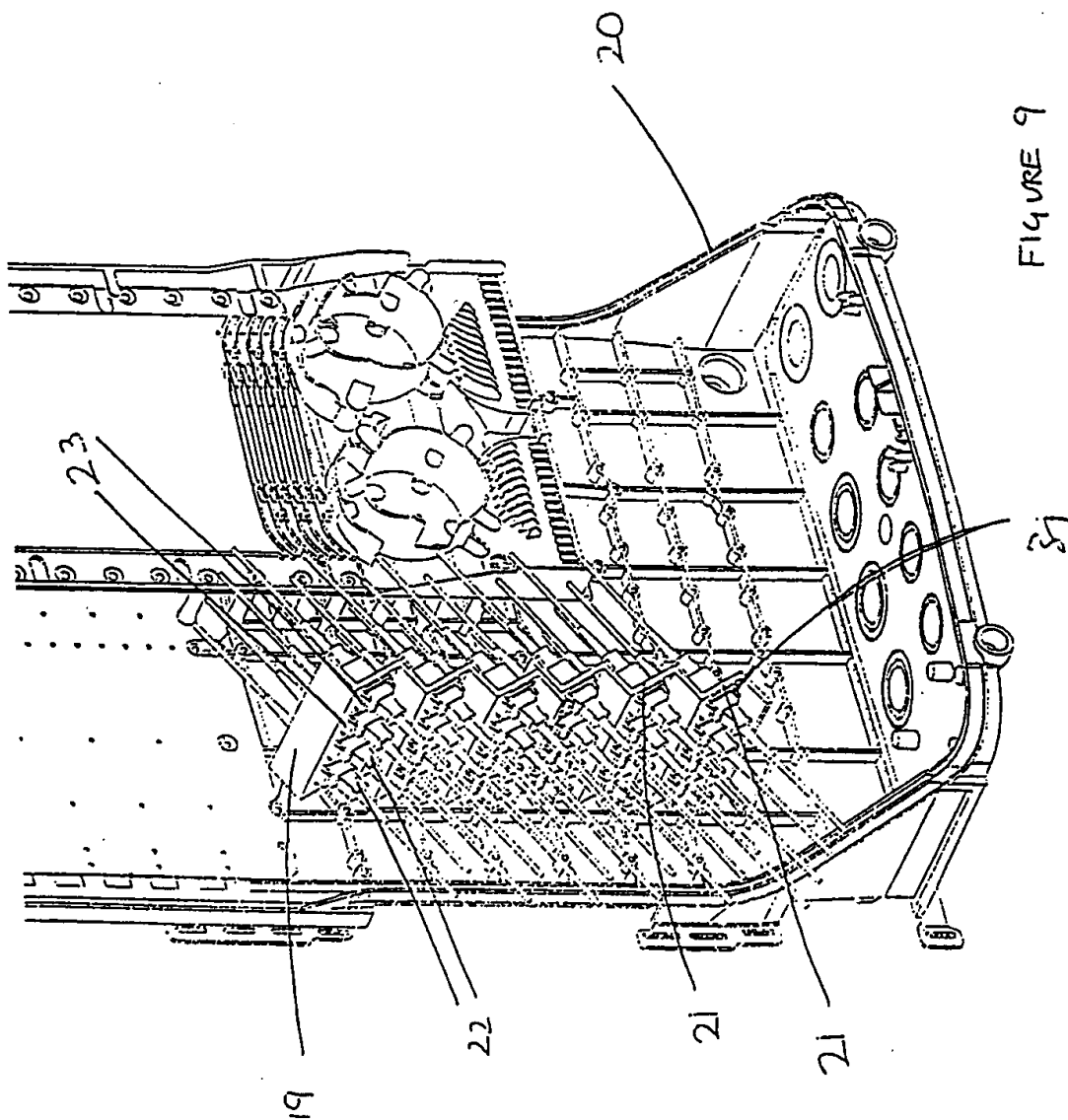












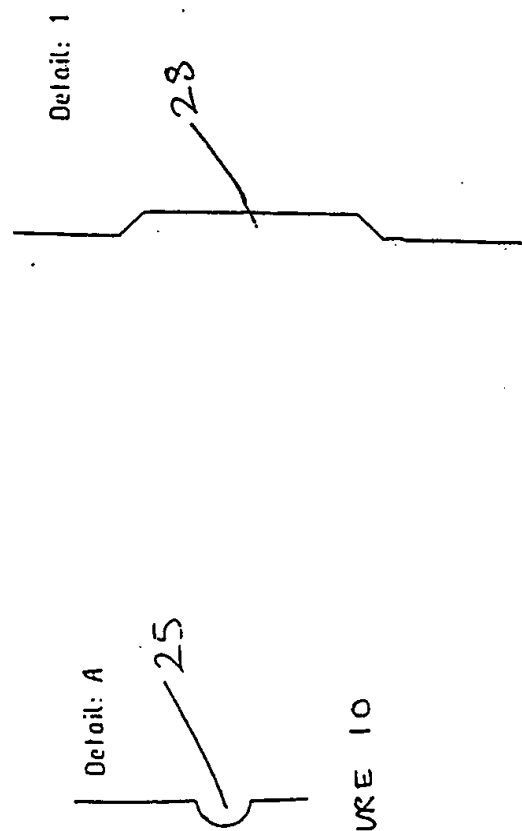
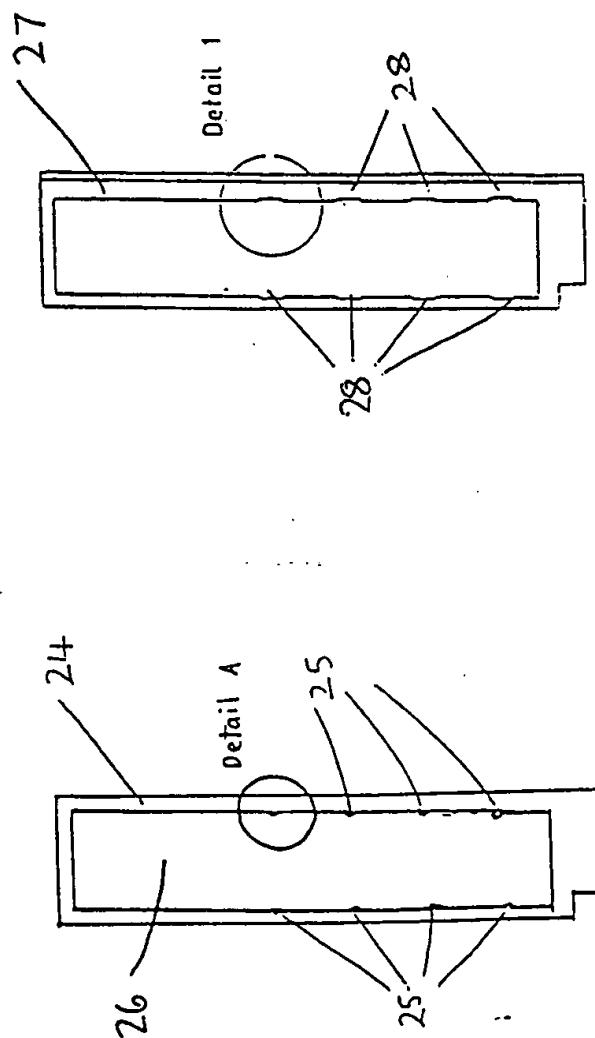


FIGURE 11

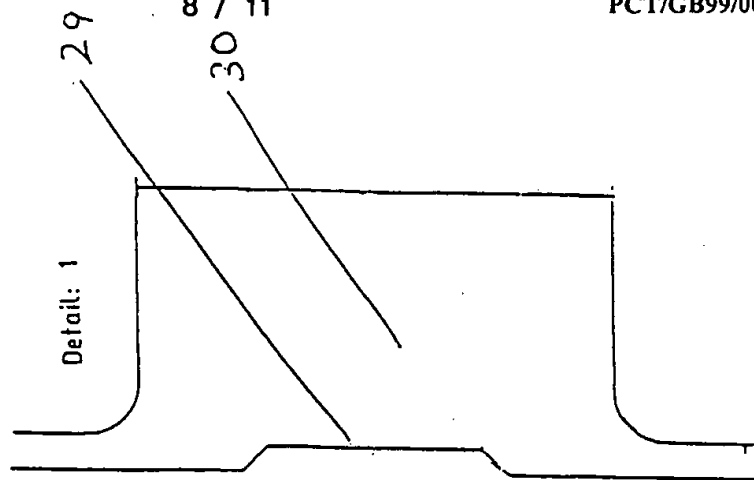
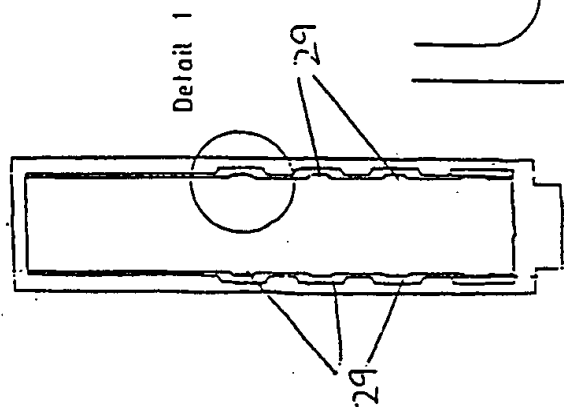


FIGURE 12

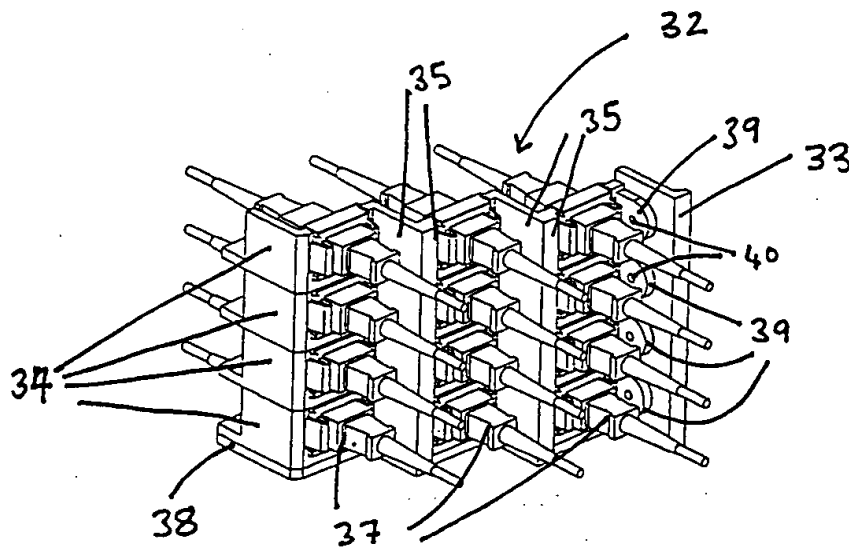


FIGURE 13

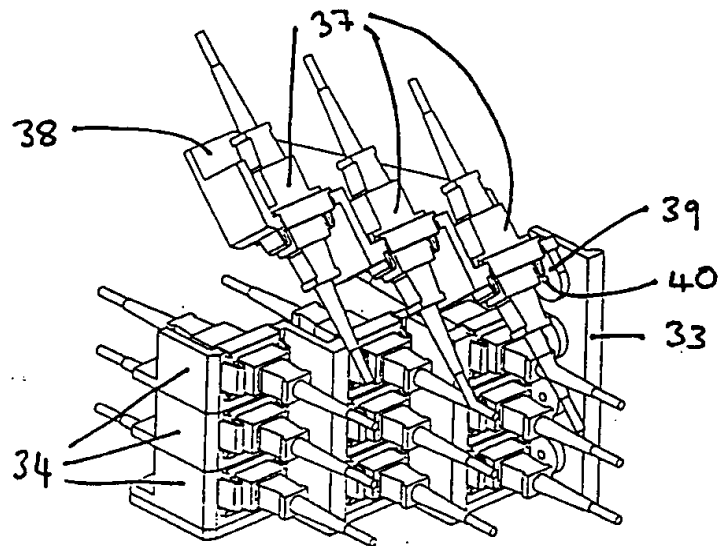


FIGURE 14

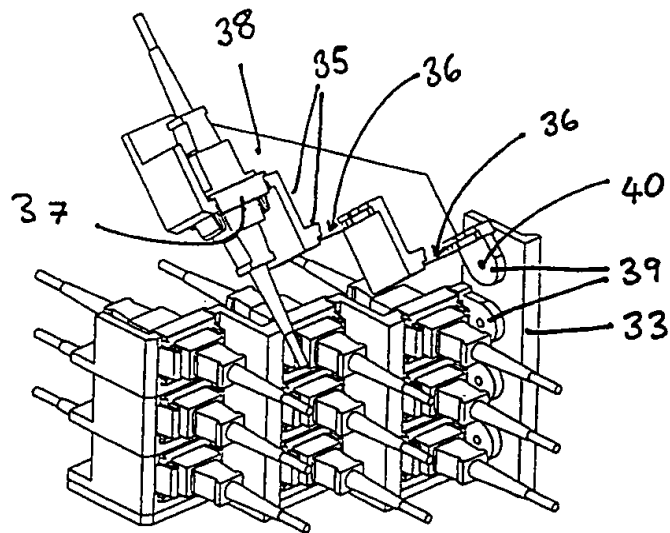


FIGURE 15

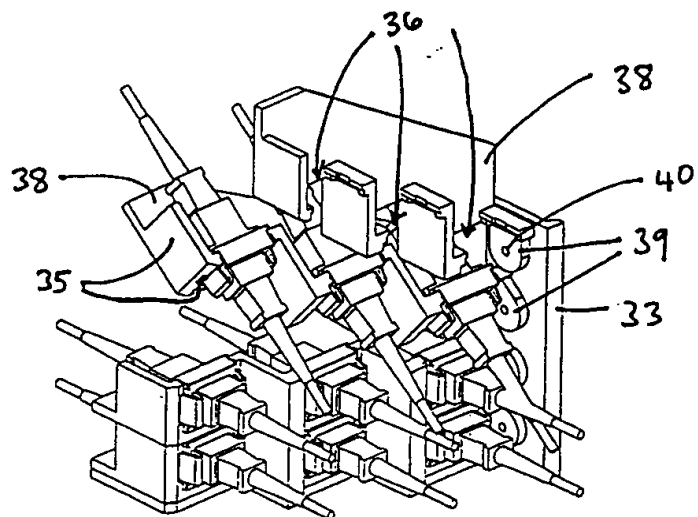


FIGURE 16

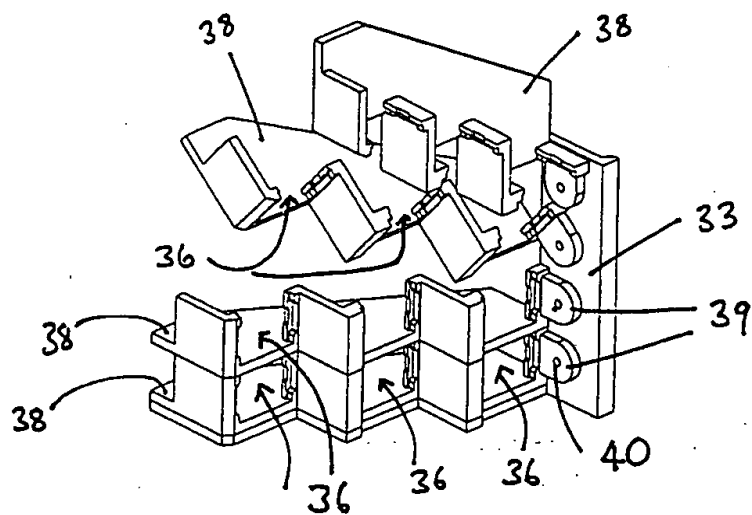


FIGURE 17

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/00318

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G02B6/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 010, no. 264 (P-495), 9 September 1986 & JP 61 090104 A (NEC CORP), 8 May 1986 see abstract ---	1-5, 8, 11
X	EP 0 508 870 A (DIGITAL EQUIPMENT CORP) 14 October 1992 see abstract; figures 2-5 see column 3, line 35 - column 4, line 6 see column 4, line 14-21 see column 5, line 28-58 ---	1-5, 7, 8
X	US 5 497 444 A (WHEELER TODD A) 5 March 1996 see abstract; figures 4, 18-21 see column 4, line 39-50 see column 5, line 30-35 ---	1, 6, 9-13
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Patent family members are listed in annex.

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Date of the actual completion of the international search

17 May 1999

Date of mailing of the international search report

31/05/1999

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European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nL.
Fax: (+31-70) 340-3016

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Beaven, G

INTERNATIONAL SEARCH REPORT

International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 986 762 A (KEITH ROGER H) 22 January 1991 see abstract; figures 2,5-7 see column 6, line 18-22 see column 6, line 43 - column 7, line 6 -----	1,10,11
X	FR 2 743 899 A (NOANE GEORGES LE) 25 July 1997 see abstract; figures 1,5,6 see page 7, line 11-28 see page 10, line 6-10 -----	1,13
X	US 5 109 467 A (HOGAN JOSEPH R ET AL) 28 April 1992 see abstract; figures 1,2,5,6 see column 4, line 18-26 -----	1,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/00318

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